

What is claimed is:

1. A method of etching a silicon-comprising substrate holder in a plasma processing system comprising:
  - placing said silicon-comprising substrate on said substrate holder;
  - introducing a reactive process gas to a process space in said plasma processing system, said reactive process gas comprising two or more of O<sub>2</sub>, a fluorine-containing gas, and HBr;
  - introducing a Noble gas to said process space in said plasma processing system;
  - applying a first radio frequency (RF) signal to said substrate holder, wherein said first RF signal comprises a frequency greater than 10 MHz;
  - applying a second RF signal to said substrate holder, wherein said second RF signal comprises a frequency less than 10 MHz; and
  - etching said silicon film.
2. The method as recited in claim 1 further comprising:
  - applying a magnetic field to said process space, wherein said magnetic field comprises a magnetic field strength ranging from 5 to 500 Gauss.
3. The method as recited in claim 1, wherein said fluorine-containing gas comprises at least one of NF<sub>3</sub>, SiF<sub>4</sub>, and SF<sub>6</sub>.
4. The method as recited in claim 1, wherein said first RF frequency is 40 MHz and said second RF frequency is 3.2 MHz.
5. The method as recited in claim 1, wherein said reactive process gas comprises HBr, O<sub>2</sub>, and NF<sub>3</sub>.
6. The method as recited in claim 5, wherein a flow rate of said HBr is about ten times greater than a flow rate of said NF<sub>3</sub>, and said flow rate of said HBr is about fifteen times greater than a flow rate of said O<sub>2</sub>.

7. The method as recited in claim 5, wherein a flow rate of said rare gas replaces said flow rate of said HBr by an amount up to and including 80%.

8. The method as recited in claim 5, wherein a flow rate of said rare gas replaces said flow rates of said HBr, said NF<sub>3</sub>, and said O<sub>2</sub> by an amount up to and including 80%.

9. A plasma processing system for etching a silicon-comprising substrate comprising:

a processing chamber comprising a process space adjacent said substrate;

a substrate holder coupled to said processing chamber and configured to support said substrate;

means for introducing a reactive process gas to said process space in said processing chamber, said reactive process gas comprising two or more of O<sub>2</sub>, a fluorine-containing gas, and HBr;

means for introducing a Noble gas to said process space in said processing chamber;

a first system which applies a first radio frequency (RF) signal to said substrate holder, wherein said first RF signal comprises a frequency greater than 10 MHz; and

a second system which applies a second RF signal to said substrate holder, wherein said second RF signal comprises a frequency less than 10 MHz.

10. The plasma processing system as recited in claim 9 further comprising means for applying a magnetic field to said process space, wherein said magnetic field comprises a magnetic field strength ranging from 5 to 500 Gauss.

11. The plasma processing system as recited in claim 9, wherein said fluorine-containing gas comprises at least one of NF<sub>3</sub>, SiF<sub>4</sub>, and SF<sub>6</sub>.

12. The plasma processing system as recited in claim 9, wherein said first RF frequency is 40 MHz and said second RF frequency is 3.2 MHz.

13. The plasma processing system as recited in claim 1, wherein said reactive process gas comprises HBr, O<sub>2</sub>, and NF<sub>3</sub>.

14. The plasma processing system as recited in claim 13, wherein a flow rate of said HBr is about ten times greater than a flow rate of said NF<sub>3</sub>, and said flow rate of said HBr is about fifteen times greater than a flow rate of said O<sub>2</sub>.

15. The plasma processing system as recited in claim 13, wherein a flow rate of said rare gas replaces said flow rate of said HBr by an amount up to and including 80%.

16. The plasma processing system as recited in claim 13, wherein a flow rate of said rare gas replaces said flow rates of said HBr, said NF<sub>3</sub>, and said O<sub>2</sub> by an amount up to and including 80%.